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PATENT

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IN THE CLAIMS:

Please find a listing of the claims below, with the statuses of the claims shown in parentheses. This listing will replace all prior versions, and listings, of claims in the present application.

1. (Currently amended) ~~An apparatus~~ A computer program for processing a color image, said computer program being embodied in a computer readable medium, comprising:

code for receiving the color image;

code for Retinex-type processing comprising:

code for cascaded recursive filtering, wherein the code for cascaded recursive filtering comprises code for infinite impulse response (IIR) filtering, and

code for correcting pixels of the input color image according to corresponding pixel values in the local statistics processor; and

code for transforming the corrected pixels into an output signal that is indexed to represent an intensity of a particular position in the color image.

2. (Currently amended) The ~~apparatus~~ computer program of claim 1, wherein the code for cascaded recursive filtering comprises a cascade of filters of the form:

$$\begin{aligned} L_{i,j}^{SE} = \max\{&\alpha(\nabla_x S)\cdot L_{i-1} + (1-\alpha(\nabla_x S))\cdot S_{i,j}, \\ &\alpha(\nabla_y S)\cdot L_{j-1} + (1-\alpha(\nabla_y S))\cdot S_{i,j}, S_i\} \end{aligned}$$, wherein L represents illumination,

$\alpha(\nabla S)$ is a scale independent parameter, S is the input color image, and ∇S is a scaled gradient, whereby SE above may be replaced by one of N, S, E, W, NE, NW, or SW according to standard compass notations corresponding to a direction of information flow.

3. (Currently amended) The ~~apparatus~~ computer program of claim 2, wherein a parameter α is a function of an input signal of the color image.

4. (Currently amended) The ~~apparatus~~ computer program of claim 3, wherein the parameter α is a function of a local gradient ∇s, which returns a constant value α_0 for large ∇s values and decreases monotonically to zero as ∇s decreases.

5. (Currently amended) The apparatus computer program of claim 4, wherein α (∇s) is scale independent.

6. (Currently amended) The ~~apparatus~~ computer program of claim 5, wherein,

$$\alpha(\nabla S, \nabla_N S, N) = \begin{cases} \dfrac{\sqrt[N]{\alpha_0^{N_0}}}{\sqrt[N]{\alpha_0^{N_0}} \cdot e^{\beta \cdot \min(\nabla S, 0)}} & \nabla_N S \geq -T, \\ & \nabla_N S < -T \end{cases}$$

wherein N is a size of the input image S, wherein $\nabla_N S$ is a scaled gradient, wherein T is a threshold value, and wherein β is a constant parameter.

7. (Currently amended) The ~~apparatus~~ computer program of claim 6, wherein the scaled gradient of the color image is

$$\nabla_N S = \sum_{i=\delta_N^- + 1}^{\delta_N^+} \left| S(i+j) - S(i+j-1) \right|$$

8. (Canceled).

9. (Currently amended) The ~~apparatus~~ computer program of claim 2, wherein the scaled gradient of the color image is

$$\nabla_N S = S\left(i + \Delta_N^+\right) - S\left(i + \Delta_N^-\right)$$

where $\Delta_N^+ + \Delta_N^- = \left\lfloor N/N_0 \right\rfloor$, and $\Delta_N^+ + 1 \geq \Delta_N^- \geq \Delta_N^+$.

10. (Currently amended) ~~An apparatus~~ A computer program for fast Retinex processing, said computer program being embodied in a computer readable medium, ~~said apparatus~~ comprising:

code comprising a robust recursive envelope operator for fast Retinex processing, said operator having a cascaded recursive filter, wherein the cascaded recursive filter is used to calculate an illumination L at a particular position in an input image signal S using the following equation:

$$L_{i,j}^{xx} = \max\{\alpha(\nabla_x S)\cdot L_{i-1,j} + (1-\alpha(\nabla_x S))\cdot S_{i,j},\ \alpha(\nabla_y S)\cdot L_{i,j-1} + (1-\alpha(\nabla_y S))\cdot S_{i,j}, S_i\},$$

wherein ∇ is a gradient function, α (∇ s) comprises a scale independent parameter, wherein xx comprises a compass notation, and wherein the robust recursive envelope operator processes the input image signal S.

11. (Currently amended) The ~~apparatus~~ computer program of claim 10, wherein α is a function of the input image S.

12. (Currently amended) The ~~apparatus~~ computer program of claim 11, wherein the function is a Huber function.

13. (Currently amended) The ~~apparatus~~ computer program of claim 10, wherein α is a function of one or more parameters,

$$\alpha(\nabla S, \nabla_N S, N) = \begin{cases} \sqrt[N]{\alpha_0^{N_0}} & \nabla_N S \geq -T, \\ \sqrt[N]{\alpha_0^{N_0}} \cdot e^{\beta \cdot \min(\nabla S, 0)} & \nabla_N S < -T \end{cases}$$

wherein N is a size of the input image S, wherein $\nabla_N S$ is a scaled gradient, wherein T is a threshold value, and wherein β is a constant parameter.

14. (Currently amended) The ~~apparatus~~ computer program of claim 10, wherein the compass notation is one or more of SE, SW, NE, NW, and wherein application of the cascaded recursive filter follows the compass notations.

15. (Canceled).

16. (Previously Presented) A computer readable storage medium on which is embedded one or more computer programs, said one or more computer programs implementing a method for processing an input image S, said one or more computer programs comprising a set of instructions for:

producing an output illumination signal through application of the following equation:

$$L_{i,j}^{SE} = \max\{\alpha(\nabla_x S)\cdot L_{i-1,j} + (1-\alpha(\nabla_x S))\cdot S_{i,j},\ \alpha(\nabla_y S)\cdot L_{i,j-1} + (1-\alpha(\nabla_y S))\cdot S_{i,j}, S_i\},$$ wherein L represents illumination,

$\alpha(\nabla S)$ is a scale independent parameter, and ∇ is a gradient function, whereby SE above may be replaced by one of N, S, E, W, NE, NW, or SW according to standard compass notations corresponding to a direction of information flow;

producing a reflectance signal from the output illumination signal;

transforming the reflectance signal into an output reflectance signal; and

outputting the output reflectance signal.

17. (Previously Presented) The computer readable storage medium according to claim 16, wherein the parameter α is a function of an input signal of the image.

18. (Previously Presented) The computer readable storage medium according to claim 17, wherein the parameter α is a function of a local gradient ∇s which returns a constant value α_0 for large ∇s values and decreases monotonically to 0 as ∇s decreases.

19. (Previously Presented) The computer readable storage medium according to claim 16, wherein a α (∇s) is scale independent.

20. (Previously Presented) The computer readable storage medium according to claim 19, wherein

$$\alpha(\nabla S, \nabla_N S, N) = \begin{cases} \sqrt[N]{\alpha_0^{N_0}} & \nabla_N S \geq -T, \\ \sqrt[N]{\alpha_0^{N_0}} \cdot e^{\beta\cdot\min\{\nabla S, 0\}} & \nabla_N S < -T \end{cases}$$

wherein N is a size of the input image S, wherein $\nabla_N S$ is a scaled gradient, wherein T is a threshold value, and wherein β is a constant parameter.

21. (Previously Presented) The computer readable storage medium according to claim 20, wherein N_0 equals 256.

22. (Previously Presented) The computer readable storage medium according to claim 20, wherein applying the cascaded filter producing an output illumination signal further comprises sequentially applying a cascaded filter following a compass notation.

23. (Previously Presented) The computer readable storage medium according to claim 22, wherein the sequential application of the cascaded filter comprises SE, SW, NW, NE compass notations.

24. (Previously Presented) The computer readable storage medium according to claim 22, wherein the sequential application of the cascaded filter comprises more than four filters in cascade.